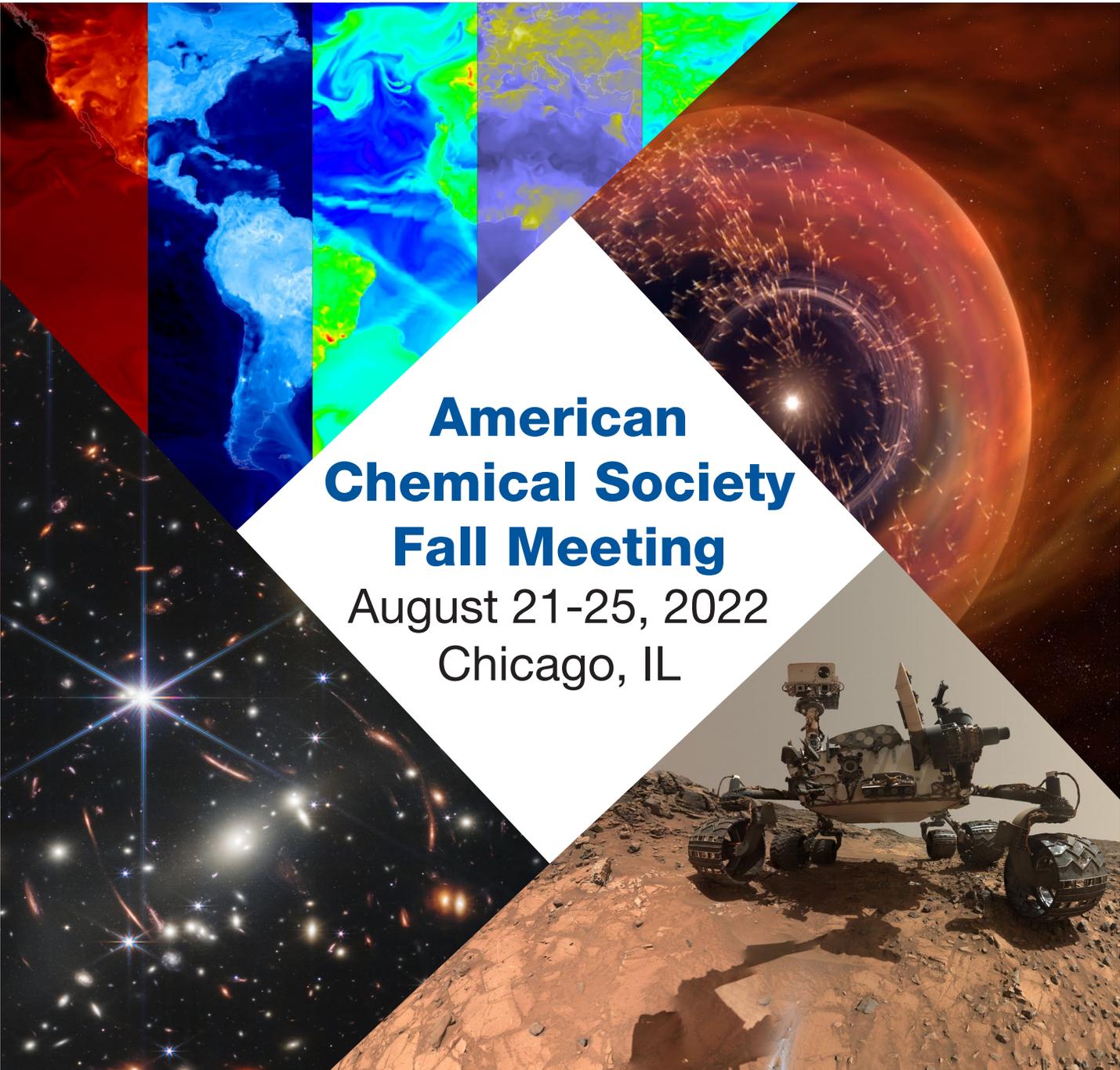




# NASA HYPERWALL SCIENCE STORIES

A collage of scientific images including a red and orange planetary surface, a blue and white map of Earth, a colorful atmospheric or fluid dynamics simulation, a large red planet with a bright star and a ring of particles, a starry night sky with a bright star, and a Mars rover on a rocky surface.

**American  
Chemical Society  
Fall Meeting**

August 21-25, 2022  
Chicago, IL

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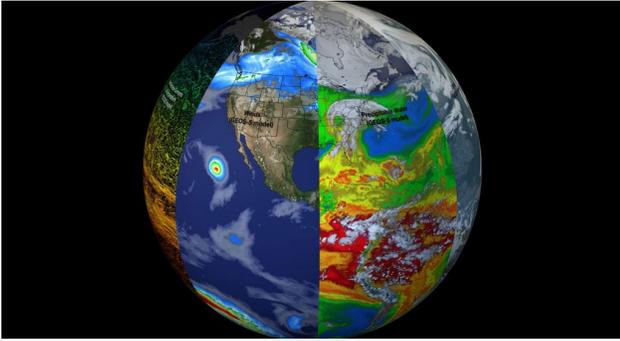
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This brochure represents some of the chemistry-related stories available on NASA's Hyperwall. For a complete list of Hyperwall stories, and to download content, visit [svs.gsfc.nasa.gov/hw](https://svs.gsfc.nasa.gov/hw)



# EARTH SCIENCE

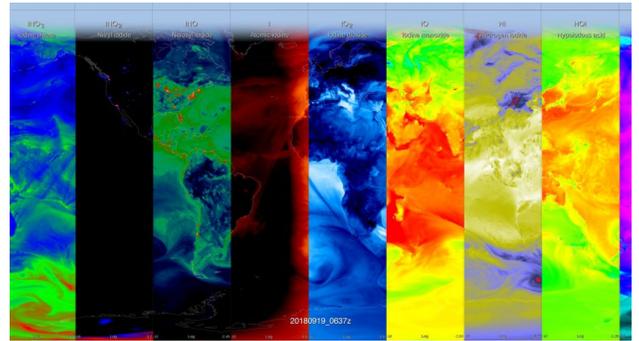
## Earth: A System of Systems



This visualization reveals that the Earth system, like the human body, comprises diverse components that interact in complex ways.

<https://svs.gsfc.nasa.gov/30701>

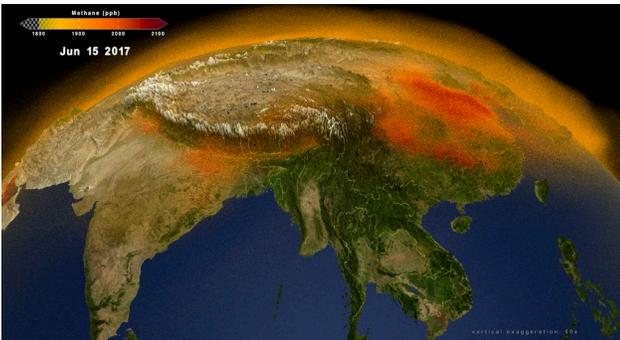
## The Complex Chemistry of Surface Ozone: GEOS Simulation



This visualization shows a computer simulation of the complexity of the chemical system of the atmosphere produced by NASA's Global Modeling and Assimilation Office (GMAO) GEOS modeling system for the time period July 22, 2018 to October 2, 2018.

<https://svs.gsfc.nasa.gov/4754>

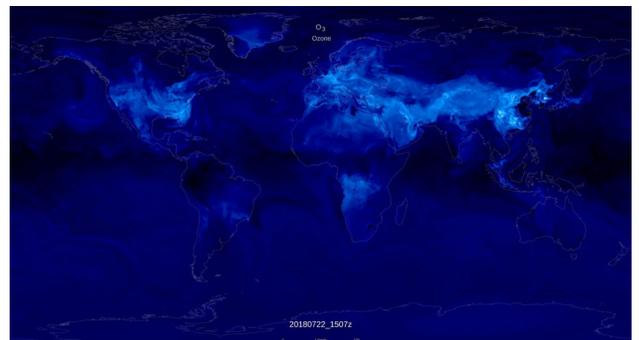
## Global Atmospheric Methane



The visualization shows the complex patterns of methane emissions produced around the globe and throughout the year from the different sources, created using output from NASA's Global Modeling and Assimilation Office (GMAO) GEOS modeling system.

<https://svs.gsfc.nasa.gov/4789>

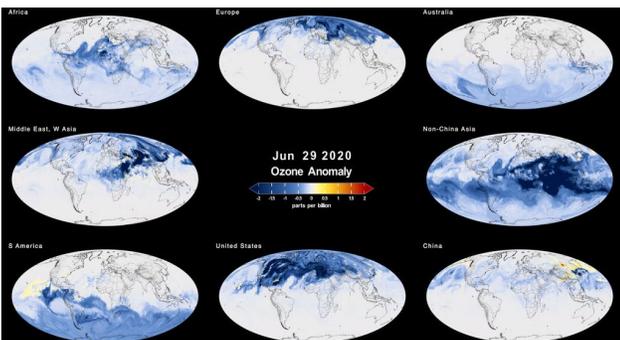
## Simulation of Surface Ozone



This animation shows the amount of ozone in the atmosphere at the surface of the Earth, as represented by the GEOS composition forecast system (GEOS-CF) for July 22 – August 10, 2018.

<https://svs.gsfc.nasa.gov/4764>

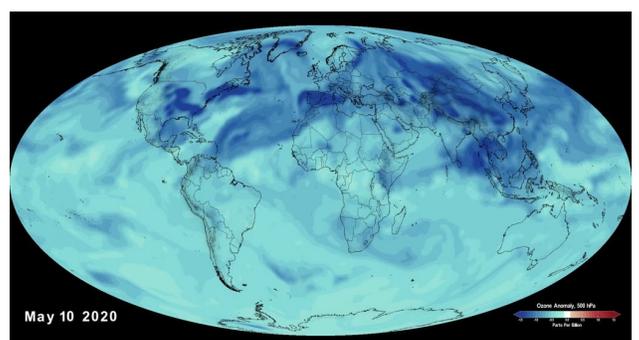
## Reduction in Tropospheric NO<sub>x</sub> and Ozone: COVID-19 Lockdowns



When the world went into lockdown to slow the spread of COVID-19, air pollution emissions started to rapidly decrease, detected by a team of scientists at NASA using satellite measurements.

<https://svs.gsfc.nasa.gov/4959>

## Global Tropospheric Ozone Response to Worldwide COVID-19 Lockdowns

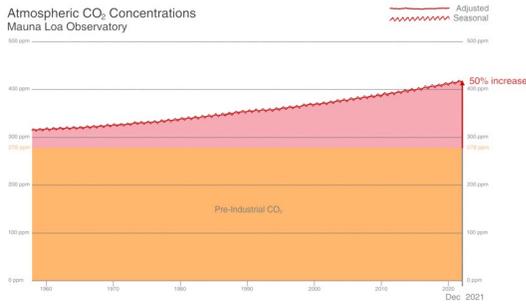


This visualization presents the results of a study done by scientists at NASA/Jet Propulsion Laboratory to quantify a decrease in global NO<sub>x</sub> emissions.

<https://svs.gsfc.nasa.gov/4912>

# EARTH SCIENCE

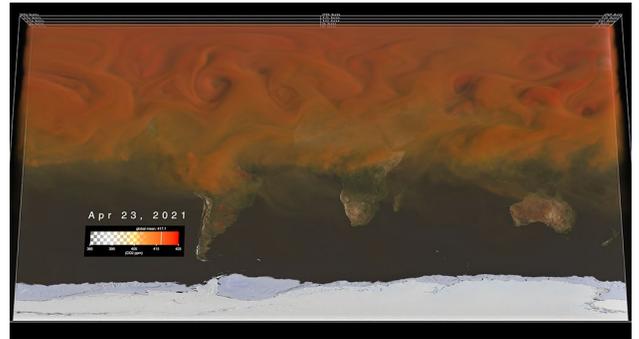
## Atmospheric Carbon Dioxide Concentrations



This timeplot uses the Keelings' complete record of Mauna Loa carbon dioxide monthly mean data to illustrate sustained increases in atmospheric carbon dioxide concentrations.

<https://svs.gsfc.nasa.gov/4962>

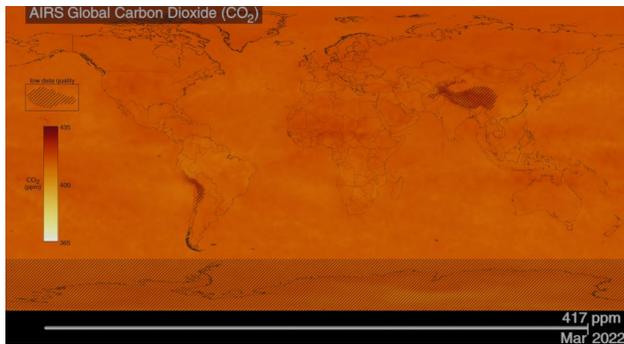
## Global Carbon Dioxide 2020-2021



NASA's Orbiting Carbon Observatory-2 (OCO-2) provides the most complete dataset tracking the concentration of atmospheric carbon dioxide, the main driver of climate change.

<https://svs.gsfc.nasa.gov/4949>

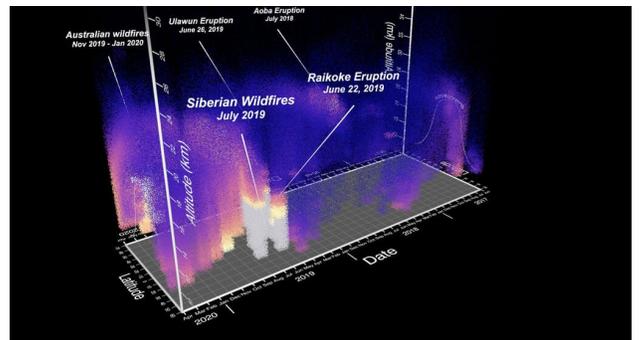
## 20 Years of AIRS Global Carbon Dioxide Measurements (2002-2022)



This data visualization shows the global distribution and variation of the concentration of mid-tropospheric carbon dioxide observed by the Atmospheric Infrared Sounder (AIRS) on the NASA Aqua spacecraft over a 20-year timespan.

<https://svs.gsfc.nasa.gov/4990>

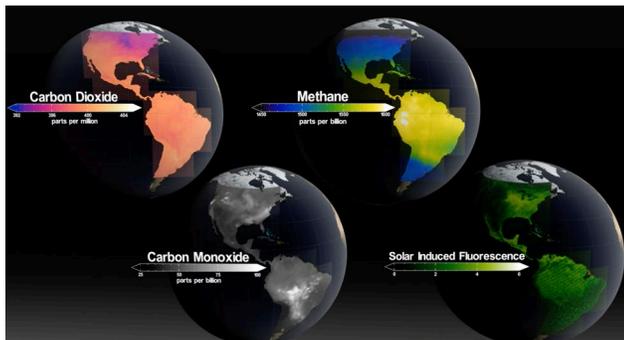
## Three years of SAGE III/ISS Stratospheric Aerosol Data



These visualizations show approximately three years of Stratospheric Aerosol and Gas Experiment III (SAGE III) aerosol data.

<https://svs.gsfc.nasa.gov/4861>

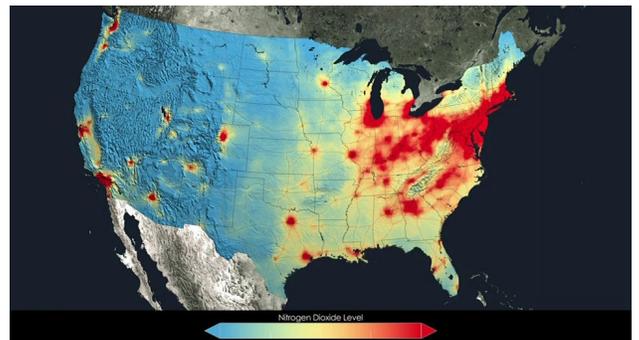
## GeoCarb Observes Greenhouse Gasses from Geosynchronous Orbit



This visualization shows the GeoCarb spacecraft orbiting the Earth. In addition to carbon dioxide, GeoCarb also measures carbon monoxide, methane, and solar induced fluorescence.

<https://svs.gsfc.nasa.gov/4890>

## U.S. Air Quality Improvement

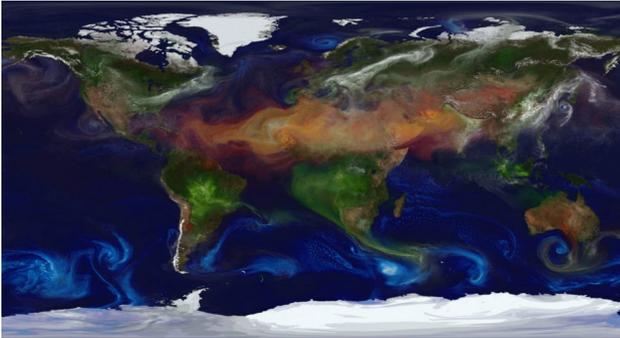


This visualization shows tropospheric column concentrations of nitrogen dioxide across the U.S. as detected by the Aura/Ozone Monitoring Instrument, averaged yearly from 2005-2011.

<https://svs.gsfc.nasa.gov/goto?11579>

# EARTH SCIENCE

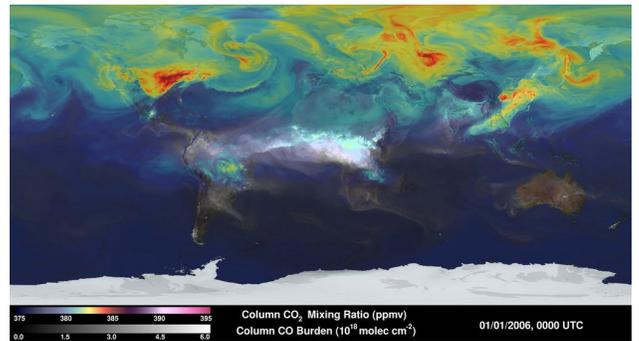
## Around the World with Aerosols



This simulation shows how sea salt and dust swirl inside cyclones, sulfates stream from volcanoes, and carbon bursts from fires from May 2005 to May 2007, produced by the GEOS-5 model.

[svs.gsfc.nasa.gov/goto?30017](https://svs.gsfc.nasa.gov/goto?30017)

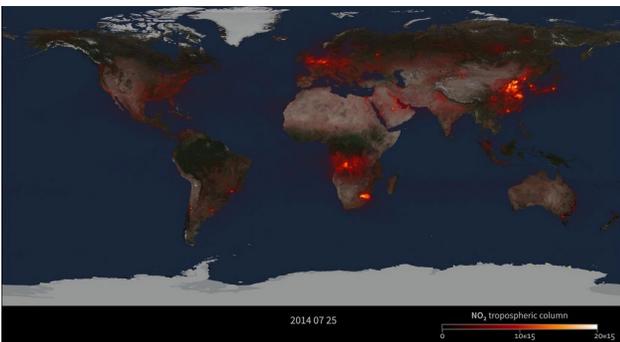
## Simulated Atmospheric Carbon Concentrations



This visualization, created using data from the 7-km GEOS-5 Nature Run model, shows average column concentrations of atmospheric carbon dioxide and carbon monoxide in 2006.

[svs.gsfc.nasa.gov/goto?30515](https://svs.gsfc.nasa.gov/goto?30515)

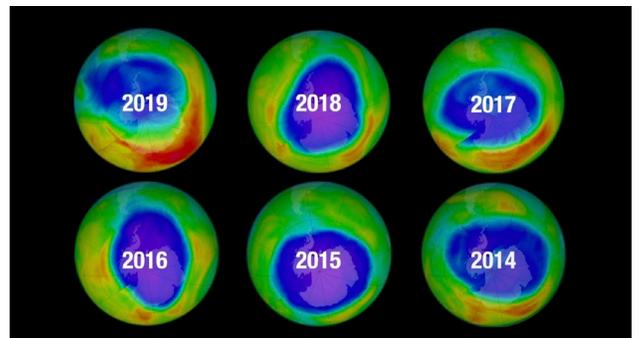
## The Air We Breathe



This sequence of daily images from September 1, 2009 to August 31, 2010, shows the global perspective of tropospheric nitrogen dioxide as measured by the Aqua/OMI instrument.

[svs.gsfc.nasa.gov/goto?30014](https://svs.gsfc.nasa.gov/goto?30014)

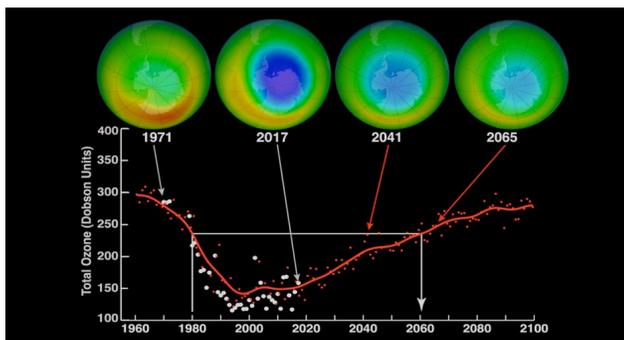
## What is the Ozone Hole?



This visualization depicts what caused the Ozone Hole, its effects on the planet, and what scientists predict will happen in future decades.

<https://svs.gsfc.nasa.gov/14037>

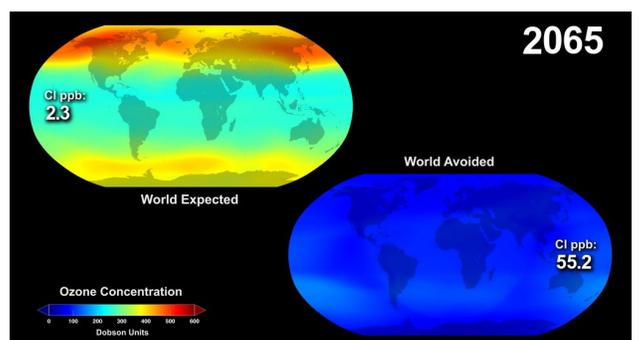
## The Antarctic Ozone Hole Will Recover



Since the mid-1990s, global ozone levels have become relatively stable. Here, the four globes show monthly-averaged total ozone over Antarctica in October.

[svs.gsfc.nasa.gov/goto?30602](https://svs.gsfc.nasa.gov/goto?30602)

## World Avoided

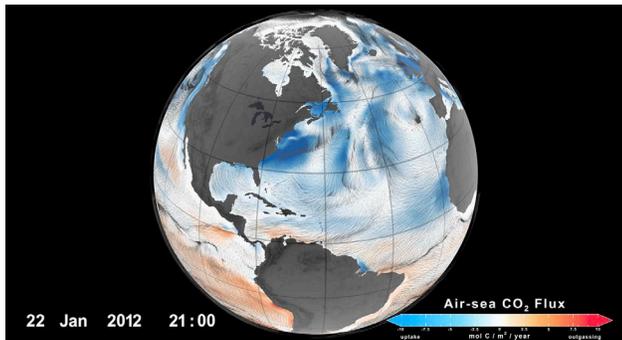


Shown here, a team of atmospheric chemists simulated what might have been if CFCs and similar ozone-depleting chemicals were not banned through the Montreal Protocol.

[svs.gsfc.nasa.gov/goto?4272](https://svs.gsfc.nasa.gov/goto?4272)

# EARTH SCIENCE

## Ocean Surface Carbon Dioxide Flux and Surface Winds



This animation shows air-sea carbon dioxide flux and surface-ocean winds from January 3 to August 15, 2012.

<https://svs.gsfc.nasa.gov/4873>

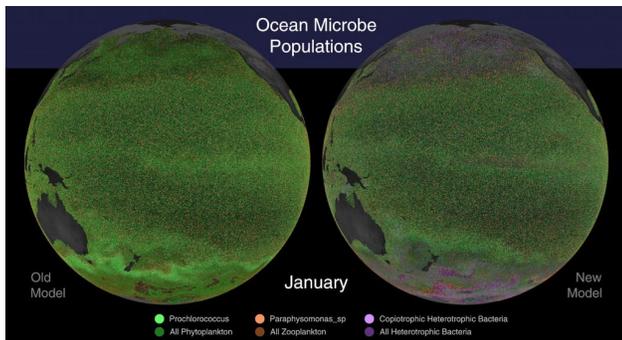
## Seaflow Search for Prochlorococcus



Research ships traveling from Hawaii into the north Pacific Ocean have measured quantities of tiny organisms in the water called Prochlorococcus using an instrument called SeaFlow.

<https://svs.gsfc.nasa.gov/4976>

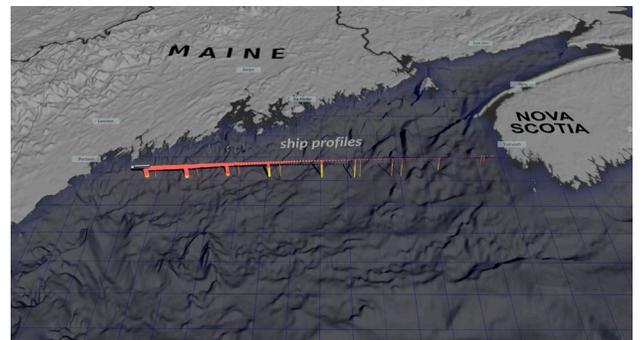
## Darwin Model of Ocean Microbes



Results from the older [left] and newer [right] Darwin model of global ocean microbiome show [left] no drop-off of Prochlorococcus populations in Arctic regions and [right] interactions between heterotrophic bacteria and shared grazer, which prevents Prochlorococcus habitat extending poleward.

<https://svs.gsfc.nasa.gov/4977>

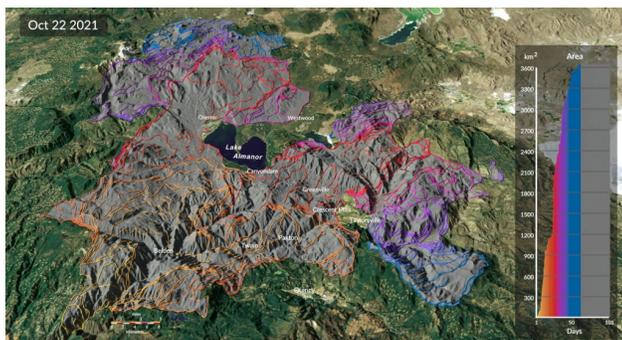
## Monitoring Changing Waters Using GNATS



The visualization shows seasonal variations in sea surface temperatures in the Gulf of Maine, while Gulf of Maine North Atlantic Time Series (GNATS) transects of temperature data are shown over time as the data are collected.

<https://svs.gsfc.nasa.gov/4971>

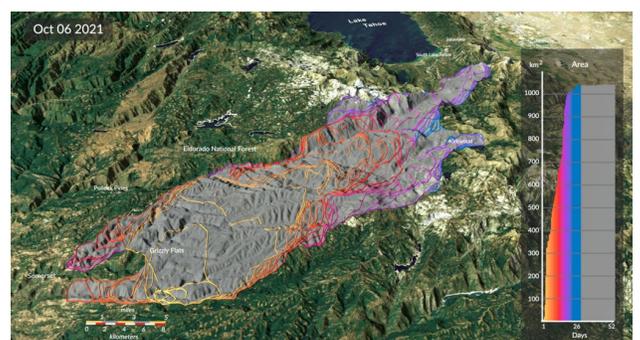
## Spread of the Dixie Fire 2021



This visualization shows the spread of the Dixie fire between July 14 and October 22, 2021, updated every 12 hours based on near-real time active fire detections from the VIIRS sensor on the Suomi NPP satellite.

<https://svs.gsfc.nasa.gov/4993>

## Spread of the Caldor Fire 2021

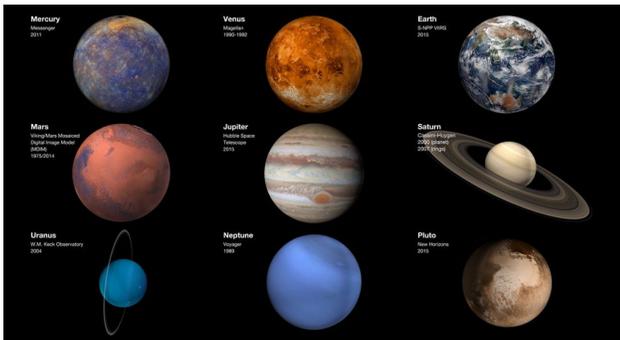


This visualization shows the spread of the Caldor fire between August 15 and October 6, 2021, updated every 12 hours based on near-real time active fire detections from the VIIRS sensor on the Suomi-NPP satellite.

<https://svs.gsfc.nasa.gov/4992>

# PLANETARY SCIENCE

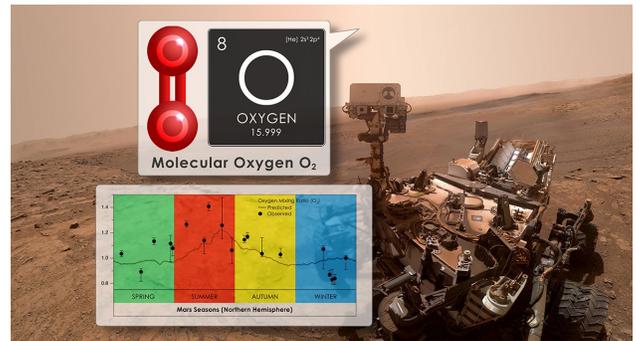
## Our Solar System



Our solar system is made up of a star—the Sun— eight planets, 146 moons, a bunch of comets, asteroids and space rocks, ice, and several dwarf planets, such as Pluto.

<http://svs.gsfc.nasa.gov/30710>

## Seasonal Variations in Oxygen at Gale Crater



NASA's Curiosity rover has measured seasonal variations in oxygen in the air directly above Gale Crater, Mars.

<https://svs.gsfc.nasa.gov/13784>

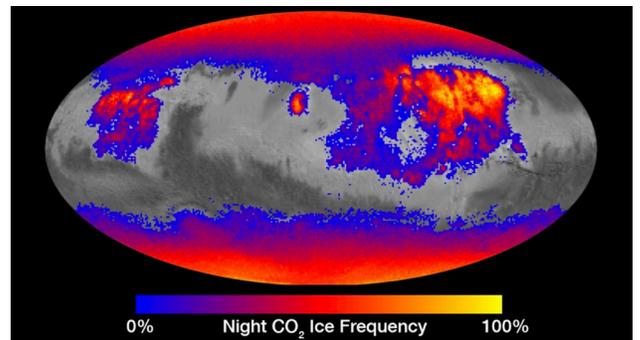
## Ancient Organics Discovered on Mars



The Curiosity rover has discovered ancient organic molecules on Mars, embedded within sedimentary rocks that are billions of years old.

<https://svs.gsfc.nasa.gov/12951>

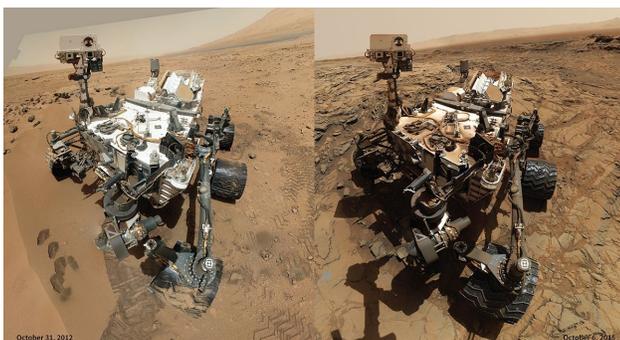
## Where on Mars Does Carbon Dioxide Frost Form Often?



This map shows the frequency of carbon dioxide frost at sunrise on Mars, as a percentage of days year-round.

<http://svs.gsfc.nasa.gov/30813>

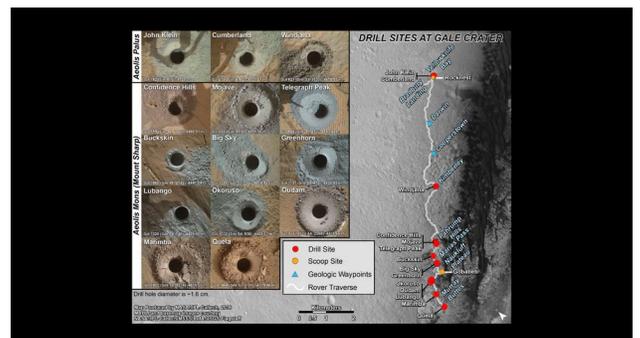
## Curiosity Selfies



This image comparison shows Curiosity on October 31, 2012 and October 5, 2015. Selfies like this allow mission engineers to track changes over time such as dust accumulation.

<http://svs.gsfc.nasa.gov/30707>

## Curiosity's First 16 Rock or Soil Sampling Sites on Mars

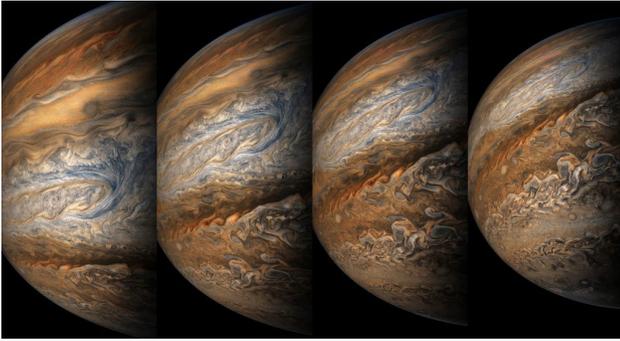


This map shows the site locations where NASA's Curiosity Mars rover collected its first 16 rock or soil samples for analysis by laboratory instruments inside the vehicle.

<http://svs.gsfc.nasa.gov/30818>

# PLANETARY SCIENCE

## Juno's Eighth Close Approach to Jupiter



This series of enhanced-color images shows Jupiter up close and personal, as NASA's Juno spacecraft performed its eighth flyby of the gas giant planet.

<https://svs.gsfc.nasa.gov/30905>

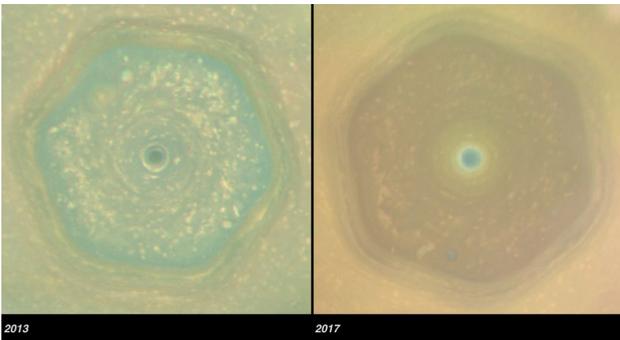
## Hubble Maps Jupiter in 4k Ultra HD



These new maps and spinning globes of Jupiter were made from observations performed with NASA's Hubble Space Telescope.

<http://svs.gsfc.nasa.gov/12021>

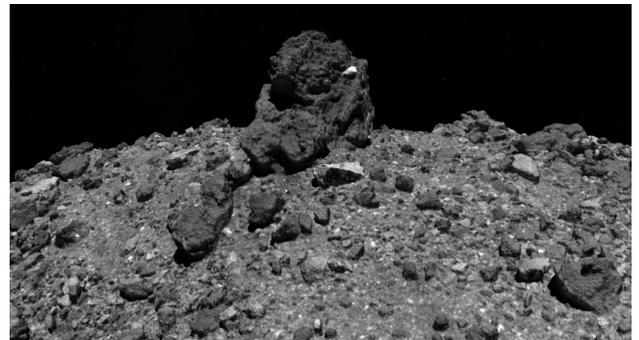
## Saturn's Hexagon as Summer Solstice Approaches



These natural color views from NASA's Cassini spacecraft compare the appearance of Saturn's north-polar region in June 2013 and April 2017.

<http://svs.gsfc.nasa.gov/30883>

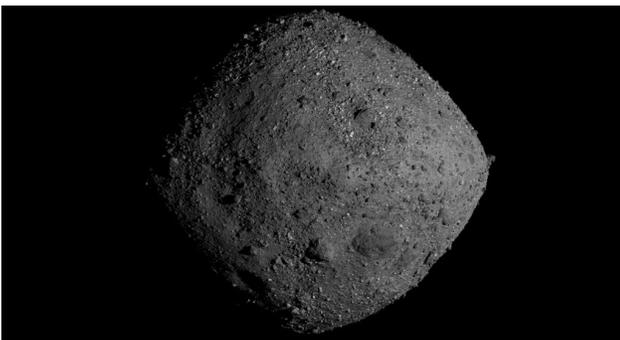
## Tour of Asteroid Benu



When NASA's OSIRIS-REx spacecraft arrived at asteroid Benu in December 2018, its close-up images confirmed what mission planners had predicted two decades before: Benu is made of loose material weakly clumped together by gravity, and shaped like a spinning top.

<https://svs.gsfc.nasa.gov/4863>

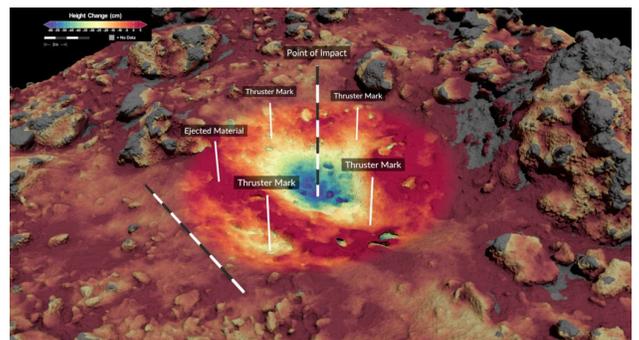
## OSIRIS-REx – Detailed Global Views of Asteroid Benu



Looping animation of asteroid Benu rotating. This 3D model of Benu was created using 20 cm resolution laser altimetry data and imagery taken by OSIRIS-REx.

<https://svs.gsfc.nasa.gov/4857>

## Benu TAG Surface Change



This visualization begins with a top-down view of a high-resolution digital terrain model (DTM) of the Nightingale Touch-And-Go (TAG) sample site on Benu.

<https://svs.gsfc.nasa.gov/5010>

# ASTROPHYSICS

## Periodic Table of the Elements: Origins of the Elements



This version of the periodic table shows our current understanding of how each element found on Earth was originally produced.

<https://svs.gsfc.nasa.gov/13873>

## Elements of Webb: Series Intro Ep0



Elements of Webb explores why engineers chose to use different materials on the James Webb Space Telescope.

<https://svs.gsfc.nasa.gov/14002>

## Elements of Webb: Gold, Part 1, Ep01



The Webb Telescope's dazzling mirrors have a microscopic layer of gold, and it isn't for aesthetic reasons.

<https://svs.gsfc.nasa.gov/14003>

## Elements of Webb: Gold, Part 2, Ep02



Different wavelengths of light are best reflected with certain metals. Learn why the James Webb Space Telescope mirrors are so well suited for infrared observation.

<https://svs.gsfc.nasa.gov/14004>

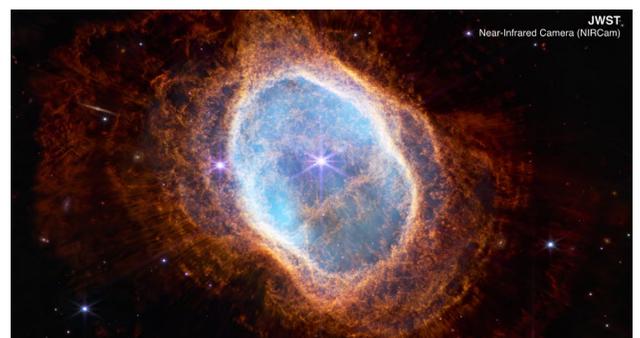
## First Images from the James Webb Space Telescope



The dawn of a new era in astronomy has begun as the world gets its first look at the full capabilities of NASA's James Webb Space Telescope, a partnership with ESA (European Space Agency) and CSA (Canadian Space Agency).

<https://svs.gsfc.nasa.gov/31186>

## First Images from Webb Compared to Hubble



In these James Webb Space Telescope (JWST) First Light images, you can see the vast improvement in resolution and clarity over images of the same regions collected by the Hubble Space Telescope.

<https://svs.gsfc.nasa.gov/31188>

# HELIOPHYSICS

## The Heliophysics Big Year



The Heliophysics Big Year is a global celebration of solar science and the Sun's influence on Earth and the entire solar system.

<https://svs.gsfc.nasa.gov/14168>

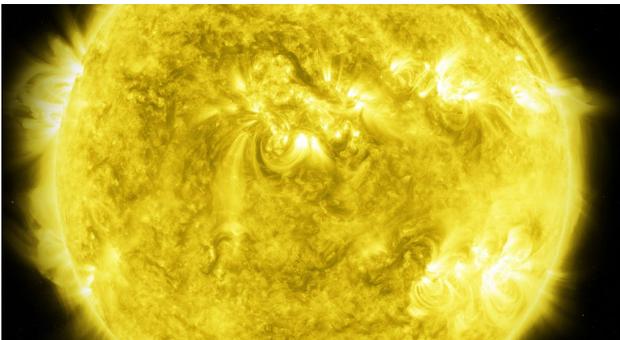
## Heliosphere



A conceptual animation showing the heliosphere—the vast bubble that is generated by the Sun's magnetic field and envelops all the planets.

<https://svs.gsfc.nasa.gov/20363>

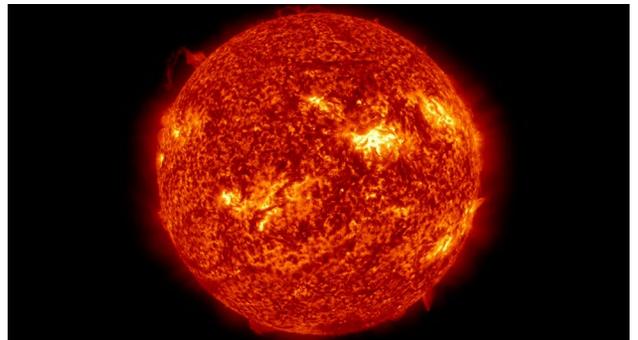
## Dynamic Earth: A New Beginning



This visualization illustrates the connections between the Earth and the Sun, as well as the power of computer simulation in understanding those connections.

<http://svs.gsfc.nasa.gov/4469>

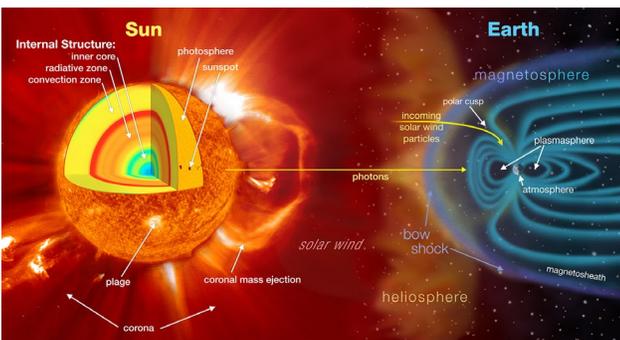
## Solar Exposures



As kids, we're taught to not look directly into the Sun. This Solar Dynamics Observatory (SDO) time-lapse video provides an opportunity to catch up on what we've been missing.

<http://svs.gsfc.nasa.gov/11755>

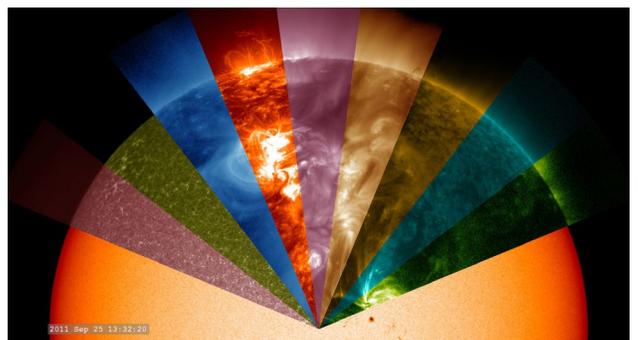
## Heliophysics and Space Weather



This illustration depicts Sun-Earth interactions that influence space weather.

<http://svs.gsfc.nasa.gov/30481>

## SDO: Argo View



Argos was the 100-eyed giant in Greek mythology. While the Solar Dynamics Observatory (SDO) has significantly less than 100 eyes, it sees the Sun through many filters.

<http://svs.gsfc.nasa.gov/4117>